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Category: atmospheric composition and chemistry

	Name	Abstract Title	Accepted Abstract Format	Abstract
1.	Edward A Celarier *UMBC/GEST*	Nitrogen Dioxide Standard Data Product from the EOS-Aura Ozone Monitoring Instrument (OMI)	Poster	Nitrogen Dioxide (NO2) is an EPA criterion air pollutant, and one of the key products from the Ozone Monitoring Instrument (OMI) aboard the EOS-Aura satellite. Besides itself being implicated in human health, it is a significant factor in tropospheric ozone (O3) production. In the troposphere, nitrogen oxides (NOx = NO + NO2) are principally produced in combustion, of both fossil fuels and biomass. Nonanthropogenic NOx sources include lightning and soil emissions. Nitrogen oxides, including NO2, are also present in the stratosphere, where NO2 catalyzes ozone loss. OMI is a hyperspectral, UV-VIS, "push-broom," CCD radiometer that measures solar radiation backscattered from the Earth/atmosphere system. The magnitude of the spectral absorption signature of NO2 in the reflectance spectrum is used to infer the column amount of NO2 in the atmosphere. Our algorithm separates the stratospheric NO2 column from the tropospheric column. Because Aura is in a sun-synchronous polar orbit, and has a field of view that extends 57 degrees either side of nadir measurements are made over 2400km swath, so the entire sunlit portion of the Earth is sampled at least once a day. The OMI measurements are nearly simultaneous with other A-train sensors. Several data products are available. The primary product is Level-2 (one file per orbit). Other products derived from Level-2 are Level-2g (gridded Level-2 data), station overpass files for over 600 locations, and Level-3 gridded data on 0.25 deg latitude-longitude resolution and on 0.05 deg resolution. The data are readily available from public archives such as GES-DISC or the AVDC. An improved version will be released at the end of 2010, enhancing the ease-of-use and interpretation.
2.	Dr. Kelly Chance *Smithsonian Astrophysical Observatory*	OMI, GOME, and SCIAMACHY lessons for the future: Ultraviolet and visible instrument requirements for monitoring NO2, SO2, HCHO, and CHOCHO tropospheric pollution from LEO and GEO	Talk	Experience in analyzing gas measurements from OMI, SCIAMACHY, and the GOME instruments has guided the development of requirements for future pollution monitoring from space, from low-earth-orbit and geostationary orbit. We present results using GSFC modeling of atmospheric composition, the VLIDORT radiative transfer model, and spectrum fitting capability developed for satellites to determine instrument requirements for future pollution monitoring. The requirements include tradeoffs among spectral resolution, signal-to-noise performance, temporal coverage, and spatial coverage. They address current Science Traceability Matrix requirements for GEO-CAPE. They conform to proven fitting capabilities that have been developed for the analysis of UV/visible satellite spectra: Proposed measurements do not require improvements over capabilities that have been demonstrated from space.

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3.	James Crawford *NASA Langley Research Center*	DISCOVER-AQ: An Earth Venture Campaign Focused on Improving the Use of Satellite Observations to Diagnose Near-Surface Air Quality	Poster	Near-surface pollution is one of the most challenging problems for Earth observations from space [Fishman et al., 2008; Martin, 2008; Hoff and Christopher, 2009]. Currently, active remote sensing of aerosols by CALIPSO provides the only direct observation of near-surface pollution, albeit for a very small nadir footprint. Otherwise, near-surface information must be inferred from column-integrated quantities obtained by passive remote sensing from nadir-looking satellite instruments. While these broad swath sensors have the advantage of providing global coverage, the interpretation of column-integrated observations is complicated by several factors. The most significant challenge exists for constituents with large relative concentrations in the stratosphere and/or free troposphere (e.g., ozone and NO2), making it difficult to distinguish the near-surface contribution to the total column. This is mitigated for NO2 since its stratospheric variability can be compensated and removed. Diminished sensitivity near the Earth's surface is another fundamental problem. In the case of NO2 and aerosols, this problem is partially alleviated by the fact that their near-surface abundance can dominate the total column amount, particularly in polluted areas. Additional challenges exist in the horizontal dimension as the resolution of current satellites and models cannot account for important sub-grid variability in ozone precursors (e.g., NOx) and their associated nonlinear chemical impacts. DISCOVER-AQ is an Earth Venture airborne campaign intended to improve the interpretation of satellite observations to diagnose near-surface conditions relating to air quality. This will be achieved through concurrent, integrated observations of column abundances and surface concentrations for key trace gases and aerosols throughout the day. These observations will be used to: 1) Relate column observations to surface conditions for aerosols and key trace gases O3, NO2, and CH2O 2) Characterize differences in diurnal variation of surface and column observations for key trace gases and aerosols 3) Examine horizontal scales of variability affecting satellites and model calculations. Expected outcomes include fundamental improvement in our understanding of the factors governing surface versus column variability, improved understanding of diurnal variability, and improved characterization of variability at scales finer than current models and satellites can resolve. This knowledge will be invaluable in leading to more effective use of current satellite observations, more effective design and observing strategies for future satellites, and improved air quality models.

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4.	Dr. Abhay Devasthale *Swedish Meteorological and Hydrological Institute (SMHI)*	The large scale changes in carbon monoxide associated with temperature inversions over Scandinavia	Poster	Temperature inversions regulate vertical transport, mixing and dilution of atmospheric pollution over the Scandinavian region during winter. This has implications for the public health. For example, previous studies show increase in asthma cases during sustained temperature inversions. Pollutants from the continental Europe, northern parts of Asia and North America are also transported over Scandinavia. Therefore, it is necessary to investigate not only the local processes, but also large-scale variability in tracers to fully understand and statistically relate the impact of pollution on public health. The satellite sensors provide independent, continuous and spatially uniform data to quantify some of the aspects mentioned above. In the present study, we make use of six years of Atmospheric Infrared Sounder (AIRS) retrievals of temperature, humidity and carbon monoxide to a) derive statistics of temperature inversions over Scandinavia and b) investigate variability in carbon monoxide associated with temperature inversions during winter. The preliminary results of these investigations will be presented here. In the next step, we will focus on individual locations in Sweden and explore usability of A-Train data together with in-situ data in characterizing sensitivity of reported public health instances to established co-variability of inversions and carbon monoxide. Finally, economical impact of observed relationships, if any, among inversions, pollution and public health will be estimated.
5.	Bryan Duncan *NASA Goddard Space Flight Center*	The Utility of the OMI HCHO & NO2 Data Products in Air Quality Decision-Making Activities	Talk	We will present three related air quality applications of the OMI HCHO (formaldehyde) and NO2 (nitrogen dioxide) data products, which we us to support mission planning of an OMI-like instrument for the proposed GEO-CAPE satellite that has as one of its objectives to study air quality from space. First, we will discuss a novel and practical application of the data products to the “weight of evidence” in the air quality decision-making process (e.g., State Implementation Plan (SIP)) for a city, region, or state to demonstrate that it is making progress toward attainment of the National Ambient Air Quality Standard (NAAQS) for ozone. Any trend, or lack thereof, in the observed OMI HCHO/NO2, which we use as an air quality indicator, may support that an emission control strategy implemented to reduce ozone is or is not occurring for a metropolitan area. Second, we will discuss how we use variations in the OMI HCHO product as a proxy for variability in the biogenic hydrocarbon, isoprene, which is an important player for the formation of high levels of ozone and the dominant source of HCHO in the eastern U.S. Third, we will discuss the variability of NO2 in the U.S. as indicated by the OMI NO2 product. In addition, we will show the impact of the 2005 hurricanes on pollutant emissions, including those associated with the intensive oil extraction and refining activities, in the Gulf of Mexico region using the OMI NO2 product. The variability of HCHO and NO2 as indicated by OMI helps us to understand changes in the OMI HCHO/NO2 and the implications for ozone formation.

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6.	Dr. Richard DUPONT *JPL/NASA/CALTECH*	Comparison between model and satellite observations using Geos-CHEM and TES carbon monoxide and ozone products	Poster	Significant fires across Asia were observed during spring 2008 during the ARCTAS campaign. The emissions of these fires contributed to atmospheric carbon monoxide (CO), carbon dioxide (CO2), aerosols, and the production of ozone (O3). In this poster we investigate the emissions and transport of biomass burning plumes using TES and MOPITT data and the GEOS-Chem adjoint. In particular we study the strength of the CO emissions and their transport patterns. Then, these updated CO emissions are used to quantify the impact of these fires on tropospheric O3, CO, CO2, and CH4.
7.	Mr. Brett Gantt *North Carolina State University*	Using A-train satellites to better understand the connection between marine aerosols and ocean biology	Poster	Sea-salt typically dominates global marine aerosol mass burden and emission rates. However, recent studies show that organic aerosols of marine origin can contribute a considerable fraction of the submicron aerosol mass concentration near biologically productive waters, therefore affecting chemical and physical characteristics of sea spray aerosols. Ambient measurements, remote sensing, and modeling studies indicate that a potentially important coupling may exist between marine-derived organic material, aerosol optical and radiative properties, cloud microphysics, and climate. We propose that organic enrichment at the air-sea interface, chemical composition of seawater, and the aerosol size are three main parameters controlling the organic fraction of sea spray aerosol (OCss). To test this hypothesis, we developed a new marine primary organic aerosol emission function based on a conceptual relationship between the organic enrichment at the air-sea interface and surface wind speed. The resulting parameterization is explored using aerosol chemical composition and surface wind speed from Atlantic and Pacific coastal stations and ocean concentrations of chlorophyll-a, dissolved organic carbon, and particulate organic carbon derived in part using the Moderate-resolution Imaging Spectroradiometer (MODIS) sensor aboard both the Aqua and Terra satellites. Of all the parameters examined, a multi-variable logistic regression revealed that the combination of 10 meter wind speed and surface chlorophyll-a concentration ([Chl-a]) are the most consistent predictors of OCss. This relationship, combined the published aerosol size dependence of OCss, resulted in a new parameterization for the organic carbon fraction of sea spray. Analysis of model simulations show that global annual submicron marine organic emission associated with sea spray is ~ 5 Tg C/yr. This study provides additional evidence that marine primary organic aerosols are a globally significant source of organics in the atmosphere whose emissions can be better understood using ocean biological and chemical proxies derived from NASA's A-Train satellites.

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8.	Dr. Scott Janz *NASA - GSFC*	Ozone Mapper and Profiler Suite (OMPS): Characteristics and improvements with respect to heritage sensors	Poster	The Ozone Mapping and Profiler Suite (OMPS) is a next-generation space-based system for monitoring global changes in stratospheric ozone. OMPS was designed and built for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) (now Joint Polar Satellite System, JPSS). This poster will describe the improvements expected from the operational OMPS profile suite products and explore potential weather and climate applications. The OMPS suite derives from a long heritage of extensively validated UV sensors flown on several successful satellite missions. It consists of three sensors designed to operate synergistically: The Nadir sensors (Nadir profiler NP and Total Column TC) determine the nadir Ozone profile and the Total Column Ozone. The Limb Profiler (LP), an experimental limb viewing sensor, measures the ozone profiles with a finer vertical resolution. The OMPS TC and NP designs are based on NASA's heritage TOMS and SBUV systems and also draw from close heritage cousins GOME, on board the second European Remote Sensing Satellite (ERS-2) and OMI, flown on EOS Aura sensors. The nadir-viewing measurements will continue the long-term data sets provided by the Total Ozone Mapping Spectrometer TOMS, the Ozone Monitoring Instrument (OMI) and the ozone profiles produced by the Solar Backscatter Ultraviolet radiometer (SBUV/2). The limb-viewing measurements will continue the limb scatter profile data set produced by OSIRIS and SCIAMACHY. The OMPS TC product algorithms are able to make use of the OMPS sensor characteristics and operational design. For example, sample tables are used for processing and uploaded to the s/c to correct for bad pixels, pixel to pixel inhomogeneities and nonlinearities. The improved design and algorithm enhancements will allow the OMPS TC to match or slightly exceed heritage TOMS performance. The OMPS Nadir Profile is designed to provide continuity for the heritage measurements from BUV, SBUV and SBUV/2. However, the instrument also provides improvements over the heritage due to its capability to provide hyperspectral coverage for wavelengths in the range between 250 nm to 310 nm with 1 nm spectral resolution. These and other enhanced capabilities will be discussed.
9.	Dr. Jianjun Jin *JPL/Caltech*	Seasonal Variability of Trans-Pacific Transport of Carbon Monoxide in the Upper Troposphere: Aura/MLS observations and model simulations	Poster	A climatological view of upper tropospheric trans-Pacific transport of air pollution is provided based on carbon monoxide (CO) measurements made by Aura Microwave Limb Sounder (MLS) at 215 hPa between 2004 and 2010. CO is a key tropospheric air pollutant and is commonly used as a tracer of pollution transport. MLS observations show strong transport of CO from Southeast Asia to North America during spring in the subtropics and mid-latitudes. Asian outflow is the strongest in summer compared with other seasons. However, in summer, air with large CO abundances only reaches to North America at about 35° N - 45° N. The transport is relatively weak in winter and fall. Occurrence probabilities of large CO abundances are used to show the transport frequencies and the most likely transport path over the North Pacific. The climatology is compared with simulations from state-of-the-art global air quality models GEM-AQ and GEOS-Chem. In addition, the long-term trend of CO in the upper troposphere over Asia, the North Pacific, and North America is investigated, with no trend in CO abundance evident in MLS observations over the six years.

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10.	Prof. Adil. H Khan Sr. *Jiwagi University India Govt.Kasturba Girls College Guna M.P.India*	Atmospheric Pollution "A cause study of Air plane Space Shuttle & Rockets Pollution & Space disaster "	Poster	In the space disaster January 28, 1986, the space shuttle Challenger exploded seventy-three seconds into its flight in air , killing the seven members with a teacher. This accident was believed the temperature of the day .Actually, the space shuttle main engines run on hydrogen and oxygen as stated above, which are mixed together to form good old fashioned H2O. Space shuttle launched produces tons of carbon dioxide and it's compound. About lot of tons harmful particulate matter settle around the launch area and nearly tons of acid kill animals. Air operation has carbon dioxide emissions of nearly tons a month and the 33,000 airplanes that fly in and out of the airport each month emit about 800,000 tons of carbon dioxide.
11.	Debra E Kollonige *UMBC*	Study of the Evolution of Stratosphere-Troposphere Exchange Events and Their Impact on the Surface	Poster	The transport or exchange of trace gases, both natural and anthropogenic, between the stratosphere and troposphere also known as stratosphere-troposphere exchange (STE) is of particular importance when studying atmospheric composition. We will use observations from NASA' s A-Train satellites to determine the spatial and temporal variability of chemical species in the UTLS due to STE with statistical methods. Our analyses focus on STE events over the continental and coastal United States where jet streaks and other dynamic phenomena are prevalent. The Atmospheric InfraRed Sounder (AIRS) onboard the Aqua satellite provides wide horizontal coverage and vertical profiles of ozone, water vapor, carbon monoxide, and temperature that capture STE events associated with the jet stream. The Tropospheric Emission Sounder (TES) onboard the Aura satellite yields higher vertical resolution of the same atmospheric tracers, but in a narrow sub-satellite swath. The HIgh Resolution Dynamics Limb Sounder (HIRDLS), also on Aura, has about 2 km vertical resolution in the upper–troposphere and lower–stratosphere (UTLS) and shows the finer details of mixing associated with STE events. Together, A-Train observations can show the evolution of STE events from inception in the UTLS to dissipation in the mid-to-lower troposphere. Besides viewing these events three-dimensionally with A-Train observations, we also use area-weighted probability distribution functions to illustrate atmospheric variability during evolving STE events. We will demonstrate that the A-Train can be a useful tool to locate the stratospheric sources of ozone enhancements measured at the surface. Back trajectories from the North American Regional Reanalysis (NARR) confirm A-Train observations.

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12.	Dr. Nickolay Krotkov *Goddard Earth Sciences and Technology Center, University of Maryland Baltimore County*	Next generation Aura/OMI NO2 and SO2 products	Talk	The measurement of both SO2 and NO2 gases was recognized an essential component of the Aura OMI mission. Standard NO2 and SO2 data have been used by a large number of researchers. Analyses of the data and validation studies have brought to light a number of areas in which these products may be expanded and improved. Though there are essential differences between the analysis of these two species, there are also important considerations they have in common, notably the necessity of accurately accounting for the radiative effects of clouds and aerosols. Major improvements for NO2 will include more accurate tropospheric and stratospheric column amounts, along with much improved error estimates and diagnostics. The new SO2 algorithm will exploit more of the spectral information about SO2 available from the OMI observations. We will operationally implement the recently developed offline extended iterative spectral fitting (EISF) algorithm and re-process the OMI Level-2 SO2 dataset using a priori SO2 and aerosol profiles, clouds, and surface reflectivity appropriate for observation conditions. This will improve the ability to detect and quantify weak tropospheric SO2 loadings. The height of the SO2 plumes will also be estimated for high SO2 loading cases (e.g., explosive volcanic eruptions). We will further improve these products through better treatment of cloud radiative physics in the operational algorithms, in collaboration with the OMI and A-train cloud/aerosol investigators to quantify and reduce cloudy-sky retrieval errors. The next generation NO2 and SO2 products will provide critical information (e.g., averaging kernels) for evaluation of chemistry-transport models, for data assimilation, and to impose top-down constraints on the SO2/NO2 column ratios that characterize anthropogenic emission sources. For example, large increases in both SO2 and NO2 were observed by OMI over several Inner Mongolian areas where new coal-fired power plants came into service during 2005-2007. OMI NO2 emissions changed little from 2007-2008 implying stable electricity output, while the dramatic drop in OMI SO2 was likely caused by the start of Flue Gas Desulfurization (FGD) operation. Further reductions in NOx and SO2 emissions are being implemented in US, where SO2 pollution levels are already low, at the edge of the OMI detection capability with the SO2 operational algorithm. These emissions controls will present an opportunity to compare reported surface and column concentrations to the improved Aura-observed changes in SO2 and NO2.

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13.	Dr. Thomas P Kurosu *Harvard-Smithsonian Center for Astrophysics*	OMI BrO, HCHO, OClO, and CHO-CHO - Status, Issues, and Updates	Poster	We present the current status and known issues of the OMI operational data products BrO, HCHO, and OClO, as well as the soon-operational product CHO-CHO. All products are affected by the OMI instrument anomaly, which leads to some loss of data. A release candidate of BrO has been updated with an albedo- and wavelength-dependent air mass factor scheme. The complete OMI data record has been processed off-line with this release candidate. OMI BrO shows excellent agreement with ground- and satellite-based observations. HCHO is affected by degradation of the UV-2 channel due to increased dark current and dead and hot pixels. Starting in 2009, the advanced degradation necessitates longer temporal averaging to obtain a reasonably noise-free signal. Pending updates to the operational HCHO product include the correction for a steady increase in HCHO background values over the OMI lifetime, as well as a redesign of the AMF approach to use radiative instead of effective cloud fraction. CHO-CHO analysis has matured over land, but still suffers from spectral interference over oceanic areas having low chlorophyll content. The influence of absorption by liquid water on the glyoxal columns is currently under investigation.
14.	Kateryna Lapina *Colorado State University*	Investigating aerosol loading in the marine environment using satellite observations and GEOS-Chem	Poster	Knowledge of the aerosol loading in the marine atmosphere is important for our ability to estimate the climate direct and indirect effects resulting from anthropogenic emissions. We present here results from our investigation of the aerosol natural marine background and transport from source regions using observations of total AOD column from satellite (MODIS) and a global chemical transport model (GEOS-Chem). We find that the model simulation of marine AOD is substantially lower away from the source regions, compared to satellite. We also use the aerosol profile product from CALIPSO to examine the detailed vertical distribution of Asian pollution and dust aerosol during its transpacific transport and to test model representation.
15.	Mr. Calvin K Liang *Joint Institute for Regional Earth System Science and Engineering*	A Multi-Sensor Perspective on the Tropical Interannual Variability of Water Vapor and Temperature	Talk	The launch of the afternoon constellation (A-Train) suite of passive and active instruments has provided an unprecedented opportunity to observationally characterize the tropospheric and stratospheric distribution of temperature and water vapor. In this work, we use the Atmospheric Infrared Sounder (AIRS) temperature data, and a newly developed joint water vapor record between the AIRS and Microwave Limb Sounder (MLS), that spans the entire atmospheric column, to quantify the variability of water vapor and temperature throughout the tropics, with a focus on interannual differences. We are able to identify the impacts of both the El Niño Southern Oscillation (ENSO) and Quasi-biennial Oscillation (QBO) on the upper tropospheric and lower stratospheric (UTLS) distribution of temperature and water vapor, and show that these modes have different impacts on water vapor and temperature depending on their phases and the location of observation. We believe that the migration of convection due to ENSO is the cause of these differences.

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16.	Dr. Xiong Liu *Harvard-Smithsonian Center for Astrophysics*	OMI Ozone profile and tropospheric ozone during 2006	Poster	Ozone profiles from surface to ~60 km (at 24 ~2.5 km layers with 4-7 layers in the troposphere) are directly retrieved from OMI ultraviolet radiance spectra (270-330 nm) after calibration of OMI radiances with MLS ozone data. The retrieved profiles contain ~6-7 degrees of freedom for signal, with 5-7 in the stratosphere and 0-1.5 in the troposphere. Vertical resolution varies from 7-11 km in the stratosphere to 10-14 km in the troposphere. Retrieval precisions range from 1% in the middle stratosphere to 10% in the lower stratosphere and troposphere. Solution errors (i.e., root sum square of precisions and smoothing errors) vary from 1-6% in the middle stratosphere to 6-35% in the troposphere, and are dominated by smoothing errors. Total, stratospheric, and tropospheric ozone columns can be retrieved with solution errors typically in the few Dobson unit range at solar zenith angles less than 80°. One year of OMI ozone profiles and tropospheric ozone during 2006 are presented. The retrieved profiles have sufficient accuracy to see ozone perturbations caused by convection, biomass burning, anthropogenic pollution, and stratospheric intrusion in the troposphere, to capture the synoptic-scale ozone gradients in the upper troposphere and lower stratosphere associated with strong PV gradients at mid-latitudes, and to identify of stratospheric waves in the tropics. Despite coarse vertical resolution and limited vertical sensitivity to ozone in the boundary layer, OMI tropospheric ozone can still provide important information about the dynamical and chemical processes controlling tropospheric ozone and to constrain air quality models that are used to forecast and analyze surface concentrations of air pollutants.

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17.	Mr. Christopher McPherson *University of Arizona*	Incorporation and Exploitation of Data from Airborne High Spectral Resolution Lidar for Improvement of CALIPSO Aerosol Retrievals	Poster	It is well known that aerosol retrievals from elastic-scatter lidars such as the Cloud Aerosol LIdar with Orthogonal Polarization (CALIOP) lidar onboard the CALIPSO satellite require at least one of several possible boundary constraints/assumptions in conjunction with the Fernald retrieval relation (F.G. Fernald, Appl. Opt., 1984), which retrieves aerosol backscatter versus range for a specified value of the extinction-to-backscatter, or lidar ratio, assumed to be reasonably constant with range. In the case of an elevated aerosol layer, direct transmittance may be used as a constraint in the retrieval, thereby determining the lidar ratio, Sa. Otherwise, a table lookup approach is commonly utilized, estimating Sa based on geographic or climatological cues. Where dual-wavelength information is available (at 532 and 1064 nm) from CALIOP, the Constrained Ratio Aerosol Model-fit (CRAM) technique (Reagan, et al., 12th AMS Atmos. Rad. Conf., 2006, Reagan, et al., IGARSS'07, 2007) has been used with some success for aerosol retrievals, as verified by accompanying measurements (McPherson, et al., J. Geophys. Res., 2010). The CRAM technique makes use of parameterizations of a number of characteristic models of aerosol (e.g., dust, biomass burning, urban/industrial, etc.) in terms of spectral ratios (~532 to 1064 nm) of aerosol extinction, backscatter and Sa, then evaluates retrievals made from the Sa pairs from the various models based on the relative degree of fitness of the retrieved spectral parameters with those of the corresponding model. The current model parameterizations are based on a study of global AERONET data, and are thought to characterize the spectral behavior of the various optical properties of a number of aerosol types observed around the world (Cattrall, et al., J. Geophys. Res., 2005). Thus, the available dual-wavelength information is brought to bear on the aerosol retrieval problem so as to improve upon retrievals which do not take advantage of this added information. High Spectral Resolution Lidar (HSRL), as it is implemented on the NASA Langley Airborne HSRL (Hair, et al., Appl. Opt., 2008) at 532 nm, employs an atomic absorption filter to differentiate between molecular and aerosol scattering, resulting in unambiguous, direct measurements of aerosol backscatter and extinction profiles, and consequently the extinction-to-backscatter (or lidar) ratio, Sa. This capability at 532 nm, together with an elastic backscatter channel at 1064 nm opens the door to a number of very interesting applications for the NASA Langley Airborne HSRL with respect to aerosol studies. Notably, an extension of the CRAM technique has been developed (Reagan, et al., IGARSS'08, 2008) to take advantage of the HSRL capability at 532 nm to additionally constrain aerosol retrievals at 1064 nm, as well as validate the assumption of spatial homogeneity of Sa that is the practical basis for aerosol retrievals via the Fernald relation. One application of this extended CRAM ("E-CRAM") technique using HSRL data at 532 nm is to make retrievals from the 1064 nm elastic backscatter channel using the additional constraint of fully known aerosol scattering parameters at 532 nm. This is done in the context of spatial regions where the Fernald retrieval assumption of limited spatial Sa variability at 532 nm can be directly confirmed so that the 1064 nm retrieval is made based on a least-squares minimization of the spatial variability of Sa at 1064 nm. This method has been shown to yield very reliable aerosol retrievals at 1064 nm across the range of Sa values observed at that wavelength. Enough HSRL data are now available (currently more than 500 flight hours in a variety of locations) that

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18.	Ms. Samiah Moustafa *student - University of Florida*	Summer 2008 California Wildfires - Using Remote Sensing and Airborne Data to Assist California's Air Resource Board	Poster (Withdrawn)	Wildfires, a natural occurrence in the state of California, plague this state's landscape every year. Summer 2008 displayed above average burning seasons in regards to the severity and frequency of fires. Recently, extreme drought seasons, coupled with historical alterations in land use, have attributed to the severity of the California fire seasons. Emissions from wildfires consist of a wide range of gases, such as carbon monoxide, carbon dioxide, and PM that contribute significantly to the tropospheric budgets on local, regional and global scales. These emissions can negatively impact photochemistry and climate on both regional and global scales. Furthermore, these fires cause both fiscal and physical damage. The summer of 2008 gave birth to one of the worse fire seasons in California's history. There were over 2700 wildfires, burning over 1,500,000 acres, in Northern and Central California. The primary ignition source was caused by a series of lightning strikes from dry thunderstorms. Data was analyzed from the NASA ARCTAS-CA mission, which consisted of a modified DC-8 aircraft flying through several biomass burning plumes over the state of California in summer 2008. In total, six flights worth of data were studied to better understand biomass burning emissions and their effect on air quality in the lower troposphere. By using satellite data to observe and characterize the burn area, pre and post fire, an understanding of what plants are more prone to burning and also what particles may be produced from different vegetation types can be formed. Additionally, by determining what aerosols and gases are found within the smoke plumes, a valuable projection model of how the fire affects the population and air quality around the fire area can be conducted. HYSPLIT trajectory models were produced to show the pathway of emissions from the wildfires. These emissions from the wildfires extended across the state of California and neighboring states. The use of remote sensing and airborne data validated that the summer 2008 wildfires not only affected the air quality of the lower troposphere, but it also had an impact on the local climate and public health.

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19.	Dr. Paul A Newman *NASA/GSFC*	The Global Hawk Pacific Mission (April-May, 2010)	Talk	The Global Hawk Pacific Mission (GloPac) was the first demonstration of the Global Hawk (GH) unmanned aircraft system (UAS) for Earth science. A principal GloPac goal was to demonstrate that the Global Hawk could be operated routinely to obtain science-quality data over remote atmospheric regions. A payload of 11 instruments was integrated onto the Global Hawk in March 2010. Initial test flights were conducted on April 2nd and 7th, followed by full science flights on April 13th, 22nd, and 30th. The science flights ranged in duration from 14 to 28 hrs, reached cruise altitudes up to 65,000 ft (19.8 km) and covered distances between 4600 nmi (8520 km) and 9700 nmi (17,960 km). The GH reached the remote Pacific between 12˚N and the Gulf of Alaska and explored the remote Arctic up to 85˚N above Alaska. No Global Hawk had previously operated north of 70˚N. A second principal GloPac goal was to explore trace gases, aerosols, and the dynamics of remote regions of the upper troposphere and lower stratosphere. The payload in situ instruments provided a number of gas measurements, including ozone, water vapor, and long-lived gases such as nitrous oxide and methane. Aerosols measurements included sizes in the range of 40 – 1000 nm diameter. Precise winds and temperatures were recorded along with the vertical temperature profile near the aircraft. A lidar system observed aerosols and clouds between the aircraft and the ground, while a spectrometer detected nitric oxide and ozone column abundances below the aircraft. Highlights of the Global Hawk flights include sampling a large fragment of the Arctic polar vortex in the Gulf of Alaska, sampling aerosol dust plumes from Asia extending from the surface to 10-km altitude over the Pacific, and extensive flight legs along the ground track of the A-train satellites coinciding with satellite overpass times. The success of the GloPac has provided a wealth of information and experience for science and operation teams that will increase the likelihood of success in future Global Hawk missions.

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20.	Dr. Mark A Olsen *UMBC/GEST*	Variability of Irreversible Poleward Transport in the Lower Stratosphere	Talk	The ascent and descent of the Brewer-Dobson circulation plays a large role in determining the distributions of many constituents in the extratropical lower stratosphere. However, relatively fast, quasi-horizontal transport out of the tropics and polar regions also significantly contribute to determining these distributions. The tropical tape recorder signal assures that there must be outflow from the tropics into the extratropical lower stratosphere. The phase of the quasi-biennial oscillation (QBO) and state of the polar vortex are known to modulate the transport from the tropical and polar regions, respectively. In this study we examine multiple years of ozone distributions in the extratropical lower stratosphere observed by the Aura Microwave Limb Sounder (MLS) and the Aura High Resolution Dynamic Limb Sounder (HIRDLS). The distributions are compared with analyses of irreversible, meridional isentropic transport. We show that there is considerable year-to-year seasonal variability in the amount of irreversible transport from the tropics, which is related to both the phase of the QBO and the state of the polar vortex. The reversibility of the transport is consistent with the number of observed breaking waves. The variability of the atmospheric index of refraction in the lower stratosphere is shown to be significantly correlated with the wave breaking and amount of irreversible transport. Finally, we will show that the seasonal extratropical stratosphere to troposphere transport of ozone can be substantially modulated by the amount of irreversible meridional transport in the lower stratosphere and we investigate how observable these differences are in data of tropospheric ozone.
21.	Dr. Steven Pawson *GMAO - NASA GSFC*	The Russian Drought and Fires of 2010: An Overview using GEOS-5 Analyses and A-Train Observations	Talk	The circulation anomalies and fires over western Russia in summer 2010 are studies using the GEOS-5 model and assimilation system in conjunction with A-Train observations. The meteorological analyses produced using GEOS-5 assimilate numerous data types, including the AMSU and AIRS instruments on EOS-Aqua. Circulation anomalies in the GEOS-5 analyses are compared to those obtained from independent observations, such as surface temperatures from MODIS, and are discussed in relation to year-to-year variations in the 30-year MERRA reanalysis computed with GEOS-5. Part of the effort to extend GEOS-5 to an "Integrated Earth System Analysis" tool involves adding chemical constituents and their emissions. This presentation focuses on distributions of carbon monoxide in GEOS-5 in comparison to retrievals from AIRS observations. Discussion focuses on the representation of CO emissions in GEOS-5, which are specified from inventories of fossil-fuel burning and from locations of biomass burning detected by the MODIS instruments, but which likely omit important sources from smoldering peatland fires. An overall objective is to demonstrate the fusion of A-Train observations and the analysis capabilities available for GEOS-5, with a view towards improving representation of processes in the model and our ability to analyze them.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
22.	Dr. Leonhard Pfister *NASA Ames Research Center*	A convective injection scheme for a trajectory-based microphysical model based on CLOUDSAT, CALIPSO, and meteorological satellite data	Poster	We have developed a trajectory-based microphysical model that can simulate the water vapor distribution in the Tropical Tropopause Layer (TTL). One ongoing goal is to properly represent the effects of convective injection in this trajectory model. For 3-D mesoscale and global models, there is substantial inter-model variability in convective cloud top altitudes. We have therefore resorted to observationally based methods. In this scheme, we use 3-hourly global meteorological satellite data (both rainfall and brightness temperature) to establish the horizontal distribution of cloud altitudes, and then "calibrate" these distributions using the absolute convective cloud altitude measurements from the CLOUDSAT and CALIOP instruments. Our simulations are then compared with measurements from the Microwave Limb Sounder. We have performed simulations for both winter and summer conditions. Convection has the greatest effect when it reaches into regions which are relatively dry and warm. In the coldest regions (e.g., the western Pacific in boreal winter), the effects of convective injection are small compared to other physics (microphysical schemes and sub grid scale waves). Convection is more important in the boreal summer.
23.	Dr. R. Bradley Pierce *NOAA/NESDIS/STAR*	Real-time Air Quality Modeling System aerosol and ozone assimilation and forecasting experiments using A-Train measurements during the NOAA CalNex field mission	Talk	During May-June 2010 the National Oceanic and Atmospheric Administration (NOAA) and the California Air Resources Board (CARB), conducted a joint field study of atmospheric processes over California and the eastern Pacific coastal region called CalNex. This study emphasized the interactions between air quality and climate change issues. The Real-time Air Quality Modeling System (RAQMS) chemical and aerosol forecasts, initialized with real-time A-Train measurements (e.g. Aura MLS stratospheric ozone profiles and OMI total column ozone retrievals, Terra and Aqua MODIS aerosol optical depth) were used for daily flight planning activities and provided lateral boundary conditions for regional air quality forecasts during CalNex. This talk presents results from post mission studies focused on evaluation of the RAQMS large-scale ozone and aerosol analyses based on comparisons with satellite, ground based, and airborne observations. Large-scale aerosol and ozone forecast skill is evaluated through analysis of anomaly correlations and forecast error covariances.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
24.	Dr. Jean-Pierre Pommereau *LATMOS CNRS*	IMPORTANCE OF TROPICAL CONVECTIVE OVERSHOOTING ON TROPOSPHERE-TO-STRATOSPHERE TRANSPORT AT THE GLOBAL SCALE FROM CALIPSO, MLS-AURA, ODIN-SMR AND OTHER SATELLITES	Poster	Deep convective overshootings of tropospheric air up to 450 K or 60 hPa have been frequently observed during recent balloon and aircraft campaigns over tropical continents. However, though successfully captured by meso-scale cloud resolving models, the mechanism is still ignored in NWPs and CCMs models, partly because of the difficulty of including such small size and short time scale events in those models, but largely because of the absence of clear observational demonstration of their impact on the lower stratosphere at the global scale. However, after the demonstration of the injection of CO, N2O, and CH4 rich tropospheric air in the lower stratosphere over Africa during the summer convective season from respectively MLS/AURA, ODIN/SMR, and HALOE/UARS observations, consistent with the maximum overshooting volume reported by the TRMM precipitation radar, a new estimation of the importance of such events is provided by the aerosols measurements of the CALIPSO lidar. Indeed, those are showing fast cleansings of the lower stratosphere to altitudes as high as 20 km during the Southern Hemisphere convective season, attributed to an injection of clean tropospheric air. The observed cleansing of the full 14-20 km equatorial belt within 1-2 months and the required tropospheric air mass flux 2 to 5 times larger than that expected from the vertical uplift by radiative heating, suggest that convective overshooting is the dominant process of the troposphere-to-stratosphere transport in the tropics. The remarkable absence of similar cleansing during the Northern Hemisphere convective season, replaced by an increase of the aerosols concentration around 18 km in contrast to other tropospheric tracers showing similar events in both hemispheres, is attributed to the difference of aerosol load of the upper troposphere of the two hemispheres.
25.	Dr. Nikita Pougatchev *Jet Propulsion Laboratory*	Retrieval of the AIRS Sounding Averaging Kernels from Correlative Measurements	Poster	To increase the utility of the AIRS retrieved profiles, in particular, their use in concert with some other remote sensors such as A-Train instruments, adequate characterization is the must. Characterization of an atmospheric retrieval relates variation of the true atmospheric state to the variation of the retrieved profile. In linear approximation an averaging kernel represents this relation. The issue is that the averaging kernels calculated based on the analysis of the retrieval algorithm may be inaccurate due to various reasons, such as forward radiative transfer model error and some other uncertainties in the retrieval algorithm. This is the reason why they perform the validation which purpose is to establish how accurately theoretical characterization represent the properties of the real retrievals. The validation of the AIRS v. 5 temperature retrievals reveals that the theoretical averaging kernels on some occasions are inaccurate. Therefore, we developed the theoretical basis and practical technique for inferring of the effective averaging kernels from correlative measurements. In the current work we present the methodology and its application. In particular, we retrieved effective averaging kernels for the AIRS temperature sounding using for the reference time series (years 2002 – 2004) of high quality RAOBs data over Lindenberg (Germany). We demonstrate noticeable improvement in the characterization of the sounding data. It is important to note the presented technique is not limited to the AIRS-type sounders but can be applied to wide variety of atmospheric remote sensors.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
26.	Dr. William G Read *Jet Propulsion Laboratory*	Convection, thin cirrus, and dehydration in the tropical tropopause layer (TTL) observed by MLS and CALIPSO.	Talk	As of May 2008, the tracks of the CALIPSO cloud profiling LIDAR observations and the Aura MLS observations of atmospheric trace gasses (e.g., H2O) and temperature are aligned within ~10km. We show that this enables the cloudiness associated with all MLS H2O measurements to be characterized from coincident CALIPSO observations, providing insights into the processes by which dehydration occurs. CALIPSO observations also help determine whether clouds are of convective origin or isolated thin cirrus. In addition, we will use the CALIOP v3 ice water content measurement to quantify how much water is present in condensed clouds, and thus determine how much water is detrained in convectively supplied ice. We will also show some initial results from CH3Cl a new MLS v3 product. CH3Cl, like CO, is enhanced in biomass burning outflow, but has a much longer chemical lifetime in the TTL then CO. Because of this, CH3Cl will be a better tracer of convective transport and supply into the TTL than CO. Preliminary results from measurements and comparison with a simple 2D model will be shown.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
27.	Prof. John A Reagan *University of Arizona*	Aerosol Mixtures Modeled in Terms of CRAM Aerosol Model Parameterizations: A Tool for Aiding A-Train Multi-spectral and Joint Sensor Aerosol Retrievals	Poster	The key to maximizing the aerosol information retrieved from CALIPSO lidar (CALIOP) observations is to make full use of the data obtained at the two CALIOP wavelengths (532 and 1064 nm) along with added constraints supplied by other A-Train instruments, such as MODIS, and/or using aerosol models such as those derived from AERONET observations or GOCART simulations. While lidar measurements at just two elastic scatter channels do not permit a practical inversion to retrieve aerosol backscatter and extinction, it is possible with the inclusion of practical constraints to achieve these retrievals. The Constrained Ratio Aerosol Model-fit (CRAM) technique is one such method which permits retrieval of aerosol optical properties from dual-wavelength lidar data by applying aerosol model constraints developed from analysis of extensive aerosol observations and inversions obtained by the AERONET global network. In particular, CRAM employs aerosol models which associate spectral ratios (~532/1064) of aerosol extinction, backscatter and the extinction-to-backscatter ratio (lidar ratio) of various aerosol types (e.g., dust, smoke, etc.)with a window range of the 532 nm aerosol lidar ratio for a given aerosol type. Dual-wavelength retrievals on lidar data made assuming the lidar ratio values for a given model yield extinction and backscatter spectral ratios that can be compared to the model ratios to confirm goodness of fit to the assumed model. Success with the CRAM approach has been demonstrated with several satellite lidar data sets. Of course situations arise where none of the CRAM models (Dust, Biomass Burning, Urban/Industrial pollution, Southeast Asia pollution and Oceanic) yield a particularly good fit, suggesting the aerosol is likely better represented as some mixture of the CRAM models. Relations have been developed to define the CRAM model parameters for various mixtures (e.g., various proportions of the Dust and Urban/Industrial model components), enabling representation of a full spectrum of aerosol combinations in terms of the CRAM spectral ratios. The Goddard Chemistry Aerosol Radiation Transport (GOCART) model is run online in the NASA GEOS-5 atmospheric general circulation model and includes global source information for major aerosol types and simulates expected mixture combinations from assimilated meteorological fields, thereby providing a means for predicting aerosol characteristics over space and time. The GEOS-5/ GOCART simulations provide aerosol parameterizations that, like the CRAM models, can be used as constraints in lidar retrievals (e.g., can provide a lidar ratio constraint). This poster presents the CRAM aerosol mixture model relationships and parameterizations for a variety of mixtures. The CRAM mixture models are also compared/related to GEOS-5/ GOCART simulation results for analogous aerosol conditions.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
28.	Dr. rahul C Reddy *Scientist*	Atmospheric Brown Clouds revealed for the first time by CALIPSO during the severe summer drought of 2009	Poster	Using Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite derived vertical profiles (Total Attenuated Backscatter at 532nm, Depolarization Ratios at 532nm and Vertical Feature Mask), monthly MODIS Aerosol Optical Depth (AOD) anomalies, National Centers for Environmental Prediction-Climate Prediction Center (NCEP-CPC) monthly precipitation anomalies and NCEP wind anomalies; we report the presence of Atmospheric Brown Clouds (ABCs) over India (65°E-95°E; 8°N-35°N) during the summer monsoon drought of 2009. CALIPSO data revealed the persistent presence a massive aerosol plume till 4 Km above sea level; this plume persisted for over 7 months (March through September 2009) over India and was loaded with anthropogenic aerosols like sulphates, black carbon products from biomass burning and fossil fuel combustion. The MODIS monthly AOD anomalies, NCEP-CPC monthly precipitation anomalies and NCEP monthly wind anomalies corroborate the presence of aerosol plume. This result revealed by CALIPSO would be helpful in formulating ABC reduction protocols over the Asian region in order ro curtail their impact on the Asian monsoon.
29.	Dr. Philippe D Ricaud *Laboratoire d'Aerologie/CNRS*	THE GROUND-BASED MICROWAVE RADIOMETER HAMSTRAD: MEASUREMENTS OF TEMPERATURE AND HUMIDITY FROM THE SURFACE TO THE UPPER TROPOSPHERE AT DOME C (ANTARCTICA)	Poster	Water vapour (H2O) plays a key role in the Earth climate system since it is the main greenhouse gas emitting and absorbing in the infrared domain. Its variability both in the troposphere and in the stratosphere is still unclear. The HAMSTRAD (H2O Antarctica Microwave Stratospheric and Tropospheric Radiometers) programme aims at developing two ground-based microwave radiometers to measure tropospheric and stratospheric H2O above the Dome C (Concordia Station), Antarctica (75°06'S, 123°21'E, 3233 m asml) over a long time period. HAMSTRAD-Tropo (hereafter named as HAMSTRAD) is a state-of-the-art microwave radiometer for measuring tropospheric H2O at 169-197 GHz (G-band, strong water vapor line, centered at 183.3 GHz), together with tropospheric temperature from the oxygen line (51-59 GHz, V-band, lower frequency wing of the oxygen line). The altitude of the Dome C site associated with a weak amount of water vapour in the troposphere and very low temperatures encountered in the lowermost altitude layers (one of the driest and coldest site around the world) favours the setting up of microwave radiometers at high frequency and with a much better sensitivity (weak integration time) with respect to sites located at sea level. The present paper will first describe the HAMSTRAD instrument. We will show results from the HAMSTRAD radiometer after being installed at Dome C in January 2009 (12 days) and continuously from January 2010 to date focussing on both H2O and temperature vertical profiles from the Planetary Boundary Layer (PBL) to the upper troposphere. These measurements will be compared against radiosondes, in situ sensors along a 45-m high tower, the nadir-viewing Infrared Atmospheric Sounding Interferometer (IASI) spaceborne sensor aboard the MetOp-A platform and the Atmospheric InfraRed Sounder (AIRS) sensor aboard the AURA platform, and the ECMWF analyses. A particular attention will be given to assess the diurnal variabilities of H2O and temperature observed in the PBL from the summer to the winter seasons.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
30.	Dr. Philippe D Ricaud *Laboratoire d'Aerologie/CNRS*	VARIABILITIES OF LONG-LIVED SPECIES OVER THE MEDITERRANEAN BASIN: MEASUREMENTS AND MODELLING	Talk	The Mediterranean Basin (MB) is a close area surrounded by many different cultural countries from Europe and Africa. Population and ecosystems are strongly influenced by the different types of pollutions (anthropogenic and natural sources) from these continents induced by the highly populated coastal cities or by the dry climate (forest fires) and also from Asia (long-range transport of pollutants). The impact of these varied continental sources is still not well understood especially on the O3 and CO budgets. Within the Chemistry-Aerosol Mediterranean Experiment (CHARMEX) Project, a particular attention is given to the variabilities and recent trends in chemical species and aerosols over the MB in order to study the weight of different processes (long-range transport, emissions, import/export, chemical transformation) on the different chemical budgets. The present paper deals with the time evolution of long-lived species (N2O, CO, CH4 and CO2) as measured by different spaceborne sensors over the MB from 2008 to 2010 and how it compares with the 3D Chemical Transport Model (CTM) MOCAGE. Satellite data used are from the nadir-viewing Infrared Atmospheric Sounding Interferometer (IASI) instrument onboard the MetOp-A platform, the Atmospheric Infrared Sounder (AIRS) sensor onboard the AURA platform and the Measurements of Pollution in the Troposphere (MOPITT) instrument onboard the Terra platform. As expected, a great variability is measured for CO and eventually CH4, but N2O and CO2 variabilities are also found to be non negligible. Interestingly, a western-eastern difference is measured within all the data sets for the four species, highlighting the different physico-chemical regimes occurring in the Eastern and Western parts of the MB. Finally, the CTM has some great difficulties to mimic the variabilities observed over the MB.
31.	Dr. Karen H Rosenlof *NOAA ESRL CSD*	Aircraft/Satellite comparisons from the HIPPO and GloPac campaigns	Talk	The HIPPO aircraft program has involved multiple pole to pole transects of the Pacific using the NCAR G-V between the surface and ~40,000 ft. Measurements on board included water vapor, ozone, carbon dioxide, carbon monoxide and other trace species and aerosol measurements. The GloPac aircraft experiment used a NASA Global Hawk flying over the Pacific in the lower stratosphere, with a peak altitude of just over 60,000 ft, and vertical profiling down to 45,000 ft. One case in particular had the Global Hawk flying above the G-V along an Aura satellite pass between Alaska and Hawaii. Comparisons of ozone and water measurements between the aircraft, AIRS and MLS measurements will be shown, as well as AIRS/aircraft comparisons for CO, CO2 and CH4.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
32.	Dr. Henry B Selkirk *GEST/UMBC*	The vertical structure of relative humidity and ozone in the tropical upper troposphere: Intercomparisons among in situ observations, A-Train measurements and large-scale models	Talk	In situ measurements in the tropics have shown that in regions of active convection, relative humidity with respect to ice in the upper troposphere is typically close to saturation on average, and supersaturations greater than 20% are not uncommon. Balloon soundings with the cryogenic frost point hygrometer (CFH) at Costa Rica during northern summer, for example, show this tendency to be strongest between 11 and 15.5 km (345– 360 K potential temperature, or ~250–120 hPa). This is the altitude range of deep convective detrainment. Additionally, simultaneous ozonesonde measurements show that stratospheric air (O3>150 ppbv) can be found as low as ~14 km (350 K/150 hPa). In contrast, results from northern winter show a much drier upper troposphere and little penetration of stratospheric air below the tropopause at 17.5 km (~383 K). We show that these results are consistent with in situ measurements from the Measurement of OZone and water vapor by Airbus In-service airCraft (MOZAIC) program which samples a wider, though still limited, range of tropical locations. To generalize to the tropics as a whole, we compare our in situ results to data from two A-Train satellite instruments, the Atmospheric Infrared Sounder (AIRS) and the Microwave Limb Sounder (MLS) on the Aqua and Aura satellites respectively. Finally, we examine the vertical structure of water vapor, relative humidity and ozone in the NASA Goddard MERRA analysis, an assimilation dataset, and a new version of the GEOS CCM, a free-running chemistry-climate model. We demonstrate that conditional probability distributions of relative humidity and ozone are a sensitive diagnostic for assessing the representation of deep convection and upper troposphere/lower stratosphere mixing processes in large-scale analyses and climate models.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
33.	Dr. Amber J Soja *NIA resident NASA LaRC*	Biomass Burning Plume Injection Height Estimates using CALIOP, MODIS and the NASA Langley Back Trajectory Model	Talk	Historically, fire plume injection heights have been modeled based on Briggs's stack rise equations, with limited verification data. Currently, there are two instruments, Cloud-Aerosol LIdar with Orthogonal Polarization (CALIOP) onboard CALIPSO (afternoon overpass) and Multi-angle Imaging SpectroRadiometer (MISR) onboard TERRA (morning overpass), that can provide the statistics necessary to verify our assumptions and improve fire plume injection height modeling for use in both small- and large-scale models. Plume height methodology and statistics have already been established using MISR data. However, CALIPSO data have not been interrogated and will provide unique datasets that complement the MISR analyses. CALIPSO data are distinct in that CALIOP randomly senses smoke from fires that burn throughout an entire solar day, unlike MISR, which captures morning plumes that are typically injected lower in altitude. Additionally, the MISR INteractive eXplorer (MINX) tool requires plumes that are optically thick and directly connected to their emission source within the same MISR scene. Together, these unique datasets will offer valuable information that moves us forward in terms of estimating the transport of fire emissions, which has applications for climate change research (black carbon in the Arctic; aerosols and clouds) and for projecting Air Quality warnings. Specifically, Moderate Resolution Imaging Spectroradiometer (MODIS) onboard TERRA and AQUA, CALIOP and the NASA Langley Research Center (LaRC) Back Trajectory Model are used to distinguish coincidence in active fires and smoke-filled air parcels. These data are used to build a database linking biomass plume injection heights to atmospheric conditions and fire behavior for the continental United States. Associated variables include ecosystems, fire names (when available), number of detections per day, atmospheric soundings, Fire Radiative Power, area burned and weather variables (i.e. temperature, relative humidity), and these associations will be used to explore the relationships between fires, weather and fire plume injection height. The Environmental Protection Agency (EPA) and LaRC are working closely to compare and benchmark results from the CALIOP plume injection database and plume injection heights modeled in the Community Multiscale Air Quality (CMAQ) model; we are optimistic concerning the potential for improving the representation of fire emissions in the National Emissions Inventory. This interdisciplinary research serves as an example of the value of the A-train constellation by pairing data from several satellites to clarify fire plume injection height, which previously relied on anecdotal verification and validation information. Currently we have the data available to establish statistics between terrestrial fire regimes and atmospheric plume injection and transport, which could have applications for moving the air quality, chemical transport modeling, and climate research communities one step closer to simulating the dynamics that define our planet.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
34.	Dr. Susan E Strahan *UMBC/GSFC*	CO in the lowermost stratosphere and its application to model evaluation: The effects of seasonally varying transport, chemistry, and sources	Talk	The AURA MLS instrument has produced a 5-year data set of CO with near global coverage as low as 345K (216 hPa). This long-term record of the upper troposphere (UT) and lowermost stratosphere (LMS) CO shows regular, seasonal cycles in sources and transport processes. Previous studies by Jiang et al. (2007) and Duncan et al. (2007) investigated the relationship between tropospheric sources and transport by convection, showing how they combined to produce some of the observed behavior in the UT and LMS. This work diagnoses chemical and transport processes in the UT/LMS by examining the seasonally varying composition of isentropic levels in the UT and LS between 345 and 410K. Sources of high CO in the tropical UT include springtime biomass burning from each hemisphere. The influence of transport by the Asian Monsoon of high levels of CO into the LMS is clearly seen every year in spring and summer. An analysis of SH LMS composition shows the importance of the role of the NH upper troposphere CO cycle. Observations show little effect of tropospheric CO on LS composition above 400K. The variations of the CO season cycles found near the tropopause and in the LMS in each hemisphere demonstrate the interplay between sources, photochemistry, and transport. The processes illustrated by the observations provide a basis for evaluating a model's abilities to represent them. Interpretation of model disagreements with observations is not simple. Two Global Modeling Initiative (GMI) chemistry and transport model (CTM) simulations are evaluated, one using meteorological fields from the GEOS General Circulation Model (GCM) and the other with fields from the GMAO GEOS5-Data Assimilation System (DAS). Each set of meteorological fields has fairly well-understood transport characteristics, so by comparing and contrasting the two CTM simulations we can identify processes that are well or poorly represented. Numerous processes are essential for realistically simulating LMS CO, including sources, strength and location of convection, and the strength of the Brewer Dobson circulation.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
35.	Mr. Stavros Stromatas *Laboratoire de Météorologie Dynamique - Ecole Polytechnique*	Using A-TRAIN observations with the regional air quality modeling for the monitoring of fire plume transport: application to Mexico and the Euro-Mediterranean	Poster	Aerosols have significant radiative and environmental impacts, affecting human health, visibility and climate. Even though remarkable progresses in aerosol modeling by chemistry-transport models (CTM) and measurement experiments have been made in recent years, there is still a significant divergence between the modeled and observed results. In this context, satellite observations offer very interesting perspectives, with good horizontal and temporal coverage. The aerosol distributions are generally characterized using aerosol optical depth (AOD) retrievals. However, AOD retrieval is challenging, and depends on a variety of different parameters such as cloud contamination, surface reflectance contributions and a priori assumptions on aerosol types. Therefore, comparisons between CTM and observations are often difficult to interpret. In this presentation, we will discuss comparisons between regional modeling (CHIMERE CTM) and satellite observations obtained by complementary missions of the A-TRAIN: MODIS, PARASOL and CALIPSO. We will more specifically focus on fire plumes monitoring – whose impact is particularly difficult to evaluate due to the sporadic and unpredictable nature of wildfires – for two regions: Mexico and the Euro-Mediterranean. After a comparison of the model AOD with the retrieved AOD, we will present an alternative methodology for direct comparison to the Level 1 observations.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
36.	Mr. Jason L Tackett *Science Systems and Applications, Inc.*	Seasonally Averaged CALIPSO Lidar Extinction Profiles Combined with MODIS Deep Blue Aerosol Optical Depth Provides Three-Dimensional Perspective of Saharan Dust Over Northern Continental Africa	Poster	During each summer in the northern hemisphere dust plumes originating from the Saharan desert are lofted above the continent and transported across the Atlantic Ocean, with both direct and indirect effects on radiative forcing. The magnitude of these effects is poorly quantified and depends on many factors – in particular, the vertical distribution. Since dust aerosols influence the radiative budget on large spatial scales, it is important to characterize their optical properties in all three dimensions to enable climate models to properly account for dust loading and the consequent effect on Earth's radiation budget. A standard metric for aerosol loading as a function of altitude is the extinction coefficient, while a metric for loading in the entire atmospheric column is aerosol optical depth (AOD). In the past, few instruments were capable of characterizing aerosol extinction in the vertical with ample spatial and temporal coverage. Meanwhile, passive remote sensors such as MODIS struggled to retrieve column AOD over bright surfaces, including the Saharan Desert. Fortunately, the A-Train based satellites CALIPSO and MODIS now overcome these obstacles with the CALIPSO version 3 release of its profile products in May 2010 featuring derived extinction coefficients and the MODIS collection 5 release of its "deep blue AOD" product, capable of AOD retrievals over bright surfaces. After five years in orbit together in the A-Train constellation, CALIPSO and MODIS Aqua yield large data sets which can be used to generate enlightening statistics. This work explores the three dimensional distribution of dust aerosol optical properties over the Saharan desert by examining average profiles of extinction coefficients for the five summers CALIPSO has been in operation (June-August, 2006-2010). Column AOD values based on these mean extinction profiles are compared to collocated MODIS Aqua "deep blue AOD" values. Examination of CALIPSO extinction in the vertical and MODIS AOD in the column over a seasonal average provides a three dimensional picture of dust loading in this region and highlights the strength of synergy between active and passive remote sensors. Collocated OMI aerosol index values are also considered to qualitatively ensure dust optical properties are being measured. A brief discussion is included on techniques for screening CALIPSO version 3 profile data to remove artifacts using built in quality assurance flags, thus improving data quality. It is the goal of this research to characterize the vertical and horizontal distribution of Saharan dust which can ultimately be used to estimate its radiative forcing and to evaluate model representations of dust plumes over northern Africa.

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37.	Dr. Hisahiro Takashima *Japan Agency for Marine-Earth Science and Technology (JAMSTEC)*	Inhomogeneity of NO2 over Yokosuka, an urban site in Japan observed by ground-based MAX-DOAS ~validation for Aura OMI	Poster	Since April 2007 continuous NO2 profile observations have been performed using ground-based Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) at Yokosuka (35.32°N, 139.65°E), an urban site in Japan. MAX-DOAS is a passive remote sensing technique using scatted visible and ultraviolet solar radiation at several elevation angles. It has been suggested that MAX-DOAS can allow us to retrieve vertical information on not only NO2 but also aerosol, H2 O, HCHO, and CHOCHO. In this study, we compare mean NO2 concentrations for 0-1 km layer derived from MAX-DOAS and surface values taken by in-situ measurements near the source region. Comparisons showed generally good agreement on seasonal, intraseasonal and diurnal time scales. However, MAX-DOAS NO2 was less than that of in-situ (surface) values particularly at higher surface values. Since the MAX-DOAS telescope used in this study was set in the azimuth direction of sea, it is expected that MAX-DOAS shows low values when the measured air masses contain information over ocean. To confirm this, MAX-DOAS NO2 was generally low when air was advected from sea. Also, for air masses measured by MAX-DOAS, the horizontal distance (depth) was estimated from the box air mass factor. We find that the concentration was generally higher when the horizontal distance was shorter, as expected. On the other hand, particularly low NO2 concentration was sometimes observed only in MAX-DOAS NO2 . For these cases, the air mass was likely vertically well mixed and the horizontal distance was long. Attention should be paid to consider such inhomogeneity to compare the MAX-DOAS measurement with in-situ surface measurement as well as to validate satellite-derived NO2 column amounts by MAX-DOAS over urban areas. In this presentation, we will also discuss the comparisons with OMI tropospheric NO2 columns over the site under clear sky or nearly clear sky conditions.
38.	Dr. Hisahiro Takashima *Japan Agency for Marine-Earth Science and Technology (JAMSTEC)*	A short-duration cooling event around the tropical tropopause and its effect on water vapor observed by Aura MLS	Poster	From analyses of recent satellite datasets, we suggested that the entry of water vapor to the stratosphere on monthly to seasonal time scales are controlled by localized, extremely low temperatures that form over a period of several days around the tropical tropopause. In the case of the 2008/2009 winter, extremely low temperatures near the tropical tropopause (~83 hPa) were observed at the beginning of February 2009 by COSMIC over the western Pacific and over eastern Pacific-South America in association with a wave response to the tropical heat source. At the same time, the water vapor field at 83 hPa detected from Aura MLS recorded a minimum, with a higher frequency of cirrus cloud observed by CALIOP. Although the temperature minima rapidly disappeared after the event, one possible interpretation is that the low water-vapor concentration remained at this level and spread gradually over the entire tropics, finally impacting on the cold phase of the atmospheric tape recorder. However, further study is required to establish a link between the large-scale reduction in water vapor and the dehydration that occurred during the cold event in early February.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
39.	Dr. Baijun Tian *Jet Propulsion Laboratory*	Exploring the Chemical Reach of the Madden-Julian Oscillation using the A-Train data	Talk	The Madden-Julian Oscillation (MJO) (aka Intraseasonal Oscillation) is the dominant component of the intraseasonal (30–90 day) variability in the tropical atmosphere. Since its discovery, the MJO has continued to be a topic of significant interest due to its extensive interactions with other components of the climate system and the fact that it represents a connection between the better-understood weather and seasonal-to-interannual climate variations. To date, influences of the MJO on the physical components of global climate system have been well recognized, documented, and in same cases, also well understood (e.g., monsoon, ENSO, hurricane, and extratropical weather). However, the impacts of the MJO on the chemical component of the climate system have been realized only recently and have not been well documented and understood. In the paper, we will present our recent exploration activities on the chemical reach of the MJO using the modern atmospheric composition satellite data. In particular, we will highlight our new findings on the MJO-related variations of water vapor (H2O) using the Aqua AIRS H2O data and the Aura TES HDO data, carbon dioxide (CO2) using the Aqua AIRS CO2 data, ozone using the Aura MLS and Aura TES ozone data, and aerosol from the MODIS AOT data.
40.	Dr. Pepijn Veefkind *Royal Netherlands Meteorological Institute (KNMI)*	The A-Train Climate Observations of Trace Gases, Aerosols and Clouds	Talk	The impact of climate change is the largest environmental challenge for mankind for the coming decades. To mitigate the risks of global warming due to the increasing concentrations of carbon dioxide and other trace gases, measures have to implemented that will have a direct impact on how people live. Because of the impact of these measures, they have to be based on solid scientific research. The A-Train with it's unique capabilities to simultaneously observe trace gases, aerosols and clouds, contributes to our understanding of climate processes. The results of the A-Train do not only increase our knowledge of today's climate, also long satellite data records can be calibrated providing new insights in atmospheric change over the last 25 years. In this contribution we show some examples of the rich A-Train climate data set. We use simultaneous observations of short lived trace gases from OMI and aerosol optical thickness from MODIS to provide information on the sources and composition of the aerosol particles. We also present long term observations of cloud properties from the visible and near infrared and use the A-Train to validate these measurements. These examples show that the A-Train data set is providing important information on the current state of the atmosphere, but also has implications for understanding existing long-term data sets and for how climate monitoring will be done in the future.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
41.	Dr. JEAN-PAUL VERNIER *NASA LANGLEY POSTDOC*	The stratospheric aerosol volcanic trend	Talk	During the last decade, stratospheric aerosols levels were monitored by several instruments including SAGE II, GOMOS, OSIRIS, CALIPSO and ground-based lidar during a period that generally is considered to be a background or at least non-volcanic. Herein, we use these measurements to investigate the role of small to moderate volcanic eruptions in controlling stratospheric aerosol levels. We find that three eruptions, from which sulfuric materials were injected into the lower tropical stratosphere, have contributed significantly to increase the aerosols loading of the global stratosphere. These eruptions are Ruang (2002), Manam (2005), and Soufriere Hills (2006). The impact of these eruptions were not instantly noted throughout the stratosphere but gradually dispersed in latitude and altitude by the general circulation and the delay of the arrival at some latitudes is sometimes as long as a year following the date of the eruption. In addition, the eruptions were successively large from Ruang to Soufriere Hills and the transport processes together with the accidental ordering of the eruption sizes created a natural volcanic positive trend in the stratospheric aerosol level on a global basis. Morever, the possible impact of anthropogenic sulfur emissions on the stratosphere aerosol level cannot be clearly determined since they are effectively masked by these volcanic eruptions. The stratospheric trend effect should be taken into account in the total Aerosol Optical Depth (troposphere+stratosphere) retrieve from other instruments of the A-train (eg. MODIS) as they may interfere with efforts to derive long-term troposphere aerosol evolution.
42.	Prof. Robert K Vincent *Bowling Green State University*	Importance of Methane Remote Sensing for Mitigation of Methane Clathrate Destabilization and Its Effect on Accelerated Global Warming	Poster	When methane clathrates (water ice with intertial methane molecules) melt, requiring a rise in ocean bottom water temperature of ony a few degrees C, they release methane from the clarates and from the natural gas plugged up behind them. Ice core records from Greenland and Antarctica show that when destabilization occurs, global warmning is accelerated by several degrees C over a few decades, whereas recent global warming has been increasing at a rate less than 1 degree C over tha past century. Recent methane clathrate destabilization has been confirmed in the Arctic continental shelf north of E. Siberia (Shakhova et al, 2010). Methods for mapping methane increases in the atmosphere with spatial resolution on the order of 100 m or less are needed to determine where methane clathrate destabilization is occurring and to determine the effectiveness of mitigation efforts to control such methane releases to the atmosphere. This is a critical need, because nothing now in orbit can map methane content in the lower troposphere at that spatial resolution.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
43.	Mr. Paul A Wagner *Jet Proupulsion Laboratory*	Version 3.30 Products from EOS MLS	Poster	Abstract for a poster Version 3.30 Products from EOS MLS Paul Wagner, William Read, Vincent Perun, David Cuddy, Honghanh Nguyen A-Train Symposium New Orleans, LA October 25-28, 2010 Jet Propulsion Laboratory California Institute of Technology In April of 2010, Earth Observing System (EOS) Microwave Limb Sounder (MLS) began production with a newer version (Version 3.30) of Level 1 and Level 2 software. By early next year, MLS intends to reprocess all of the mission data with these newer algorithms. Version 3.30 of MLS algorithms includes minor updates to Level 1 software; improvements in our Level 2 data products; and the addition of a new data product CH3Cl. Updates to Level 1 include refining the Galactic Core for the instrument field of view. Improvements in Level 2 include O3 at higher vertical resolution with twice the resolution through the troposphere and the lowest altitude at which the product is useful has been pushed from 215 hPa down to 260 hPa; H2O with removal of a kink at 2.3 hPa; CO with a reduced high bias; ClO with a reduced negative bias; HCl with the removal of a kink near the stratopause; CO with a reduced high bias; ClO with a reduced negative bias; HCl with the removal of various kinks; and CH3CN is improved. For every product we make it easier to exclude heights and geographic locations where the quality is known to be poor. Version 3 metadata employs eXtensible Markup Language (XML) format replacing the old Object Definition Language (ODL) format. The standard products have been augmented with extra dimension fields to make them compatible with the newest version of hdf5-based netCDF. The Goddard Earth Sciences Data and Information Services Center (GES-DISC) archives and distributes these products to users.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
44.	Yuhang Wang *Georgia Institute of Technology*	OMI-derived NOX Emission Reduction and its Effects on Ozone during the 2008 Olympic Games	Poster	Assimilated inversion on a daily basis using OMI tropospheric NO2 columns is developed and applied in a regional chemical transport model (REAM) to constrain fossil fuel (FF) NOx emissions over East Asia. The iterative nature of the assimilated inversion improves upon the widely used monthly-mean inversion by accounting for the chemical feedbacks of changed NOx emissions and reducing the dependence of the a priori emissions. We applied the daily assimilated inversion method to estimate NOx emissions for June-September 2007 and 2008 on the basis of the Aura Ozone Monitoring Instrument (OMI) observations of tropospheric NO2 columns and model simulations using REAM. Comparing the same periods for the two different years, significant emission reductions were found in urban and rural Beijing. The emission reduction began in early July and was in full force by July 20, corresponding to the scheduled implementation of emission controls over Beijing. The emissions did not appear to recover after the Paralympics. A 27% reduction in anthropogenic NOX emissions was estimated over urban Beijing areas during the full emission control period (July 20 – September 20). The emission reductions were much smaller over rural Beijing (13%) and the surrounding Huabei Plain (5%). Over the rest of the northeastern and southeastern China, the emission changes were negligibly small (< 0.5%). Despite that the emission reduction in Beijing is large, model simulations suggest that its effect on ozone concentrations is relatively minor using a standard VOC emission inventory in China. Adjusting the model emissions to reflect in situ observations of VOCs in Beijing, the model estimate suggests a larger effect of emission reduction.
45.	Yuhang Wang *Georgia Institute of Technology*	Global isoprene emissions constrained by OMI formaldehyde column measurements	Talk	OMI HCHO column measurements for 2006 are used as a constraint to infer the a posteriori global isoprene emissions. We used the MEGAN algorithm for a priori isoprene emission inventory and the GEOS-Chem global CTM for a forward model. Bayesian inversion was conducted by continent for five significant HCHO sources. The sources include isoprene emissions from broadleaf trees (1) and shrubs (2), the other remaining biogenic hydrocarbon emissions (3), and hydrocarbon emissions from biomass burning (4) and fossil fule and industrial sources (5). Beside surface temperature, soil moisture also significantly affects a priori isoprene emissions. The a priori isoprene emissions we estimated are 401 Tg C yr-1. The estimated a posteriori emissions of 266 Tg C yr-1 constrained by the OMI HCHO column measurements are ~34% lower, using the standard GEOS-Chem isoprene oxidation chemistry. Recent field measurements indicate direct OH production during isoprene oxidation. We explore the sensitivity of a posteriori isoprene emissions to direct OH yield from isoprene oxidation. The effect is small when the yield is 2 OH per isoprene oxidized When the yield is increased 4 OH per isoprene oxidized, the effect is moderate, increasing the a posteriori global isoprene emission to 340 Tg C yr-1 .

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	Name	Abstract Title	Accepted Abstract Format	Abstract
46.	Dr. Juying X Warner *UMBC/JCET*	Improved agreement of AIRS tropospheric carbon monoxide products with other A-Train sensors using optimal estimation retrievals	Poster	We present in this poster an alternative retrieval algorithm for the Atmospheric Infrared Sounder (AIRS) tropospheric Carbon Monoxide (CO) products using the Optimal Estimation (OE) technique, which is different from the AIRS operational algorithm. The primary objective for this study was to compare AIRS CO, as well as the other retrieval properties such as the Averaging Kernels (AKs), the Degrees of Freedom for Signal (DOFS), and the error covariance matrix, against the Tropospheric Emission Spectrometer (TES) and the Measurement of Pollution in the Troposphere (MOPITT) CO, which were also derived using the OE technique. We also demonstrate that AIRS OE CO results are much more realistic than AIRS V5 operational CO, especially in the lower troposphere and in the Southern Hemisphere (SH). These products are validated with in situ profiles obtained by the Differential Absorption Carbon Monoxide Measurements (DACOM), which took place as part of NASA's Intercontinental Chemical Transport Experiment (INTEX-B) field mission that was conducted over the northern Pacific in Spring 2006. To demonstrate the differences existing in the current operational products we first show a detailed direct comparison between AIRS V5 and TES operational V3 CO for the global datasets from Dec. 2005 to July 2008. We then present global CO comparisons between AIRS OE, TES V3, and MOPITT V4 at selected pressure levels as well as for the total column amounts. We conclude that the tropospheric CO retrievals from AIRS OE and TES V3 agree to within 5–10 ppbv or 5% on average globally and throughout the free troposphere. The agreements in total column CO amounts between AIRS OE and MOPITT V4 have improved significantly with a global relative RMS differences at 12.7%.
47.	Jacquelyn Witte *SSAI at NASA/GSFC*	Tracking the August 2010 Russian forest fires using A-Train measurements	Talk	Since mid-June 2010 central and northwestern Russia have been experiencing an unprecedented heat wave characterized by prolonged high temperatures (~ 40degC) and drought conditions. The heat wave sparked intense fires from nearby peat bogs and forests transporting plumes of smoke over Moscow and surrounding regions through-out early August. Consequently, the city experienced very unhealthy pollution levels, i.e. carbon monoxide (CO) and ozone, containing combustion products from peat bogs and wildfires, mixed with local emissions from vehicles and industry. We track the extent and evolution of the smoke plumes as they enter Moscow using Aura's Ozone Monitoring Instrument (OMI) and MODIS cloud and aerosol products, as well as MODIS fire count data. We look at the climatology of summertime UV aerosol Index (UVAI) since 2005, which contrasts the measurements during the Russian wildfire event. Additional observations come from MISR Plume Heights. We also track the extent and severity of the regional pollution using OMI Tropospheric NO2 and AIRS CO. NO2 and CO are known precursors of photochemical smog.

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	Name	Abstract Title	Accepted Abstract Format	Abstract
48.	Dr. Jerry R Ziemke *University of Maryland Baltimore County*	Innovative Use of A-Train Measurements to Study Tropospheric and Stratospheric Ozone and Other Trace Gases	Talk	This presentation provides an overview of several new research results based on A-Train satellite data. The primary data sets involved in this research are from Aura OMI and MLS, and Cloudsat. Nearly six years of tropospheric and stratospheric ozone and other trace gases derived from Aura OMI and MLS satellite measurements have provided a long data record for evaluating several important science issues. Trace gases from MLS and OMI in this study include ozone, CO, and H2O. One topic of this discussion will be on cloud properties and a new method for measuring ozone inside deep convective clouds from OMI. Another topic to be discussed is that of measuring trends (1979-present) in tropospheric and stratospheric ozone and implications for potential long-term changes in the Brewer-Dobson Circulation.